DEPARTMENT OF THE INTERIOR THE MAP OF THE POWDERHORN WILDERNESS STUDY AREA WAS PREPARED IN COOPERATION UNITED STATES GEOLOGICAL SURVEY WITH THE U.S. BUREAU OF LAND MANAGEMENT APPROXIMATE BOUNDARY OF POWDERHORN WILDERNESS STUDY AREA GUNNISON COUNTY HINSDALE COUNTY 1766 POWDERHORN WILDERNESS STUDY AREA TPI Tbb 766 Tol Larson Creek CANNIBAL PLATEAU ROADLESS AREA Taf BOUNDARY OF ANNIBAL PLATEAU ROADLESS AREA Taf Taf Base from U.S. Geological Survey; Hinsdale County, Colorado, 1978, and Geology compiled in 1979 Gunnison County, Colorado, 1975.

MINERAL RESOURCE POTENTIAL AND GEOLOGIC MAP OF THE POWDERHORN WILDERNESS STUDY AREA AND CANNIBAL PLATEAU ROADLESS AREA, GUNNISON AND HINSDALE COUNTIES, COLORADO

CONTOUR INTERVAL 80 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

By
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1983

CORRELATION OF MAP UNITS

Surficial deposits

Qs Ql Qf

Lavas Intrusive rocks

Tbb XTilX Miocene

Ash-flow Taf Ash-flow tuff

Tpl Unconformity

Unconformity

Unconformity

Unconformity

Unconformity

Unconformity

FC

PRECAMBRIAN

DESCRIPTION OF MAP UNITS

- QUATERNARY SURFICIAL DEPOSITS

 SURFICIAL DEPOSITS--Include alluvium,
 colluvium, terrace gravel, and glacial
 deposits
- deposits

 LANDSLIDE DEPOSITS--Range from chaotic,
 unsorted debris to coherent blocks of
 bedrock that slumped as units. Locally
 mixed with surficial deposits (Unit Qs)
- mixed with surficial deposits (Unit Qs)

 Qf EARTHFLOW--Mostly clayey, altered bedrock
 that shows conspicuous characteristics of
 flow movement. Chevrons point in
 direction of flow

 MIOCENE FLOOD-BASALT LAVA FLOWS AND RELATED ROCKS
- Predominantly dark, fine grained, and vesicular; at places associated with light-colored, basal rhyolitic tuff. Visible phenocrysts include biotite and feldspar. Part of the bimodal and mixed lava assemblage of Lipman and others

MIOCENE LATE INTRUSIVE ROCKS

BASALTIC TO ANDESITIC LAVA FLOWS--

(1970). Dated as 18.6-14.0 m.y. (Lipman and others, 1970)

QUARTZ MONZONITE TO RHYOLITE—Forms subvolcanic plugs and related dikes. Trout Creek plug is gray, medium—fine—grained, holocrystalline rock with phenocrysts of sodium and potassium feldspar, amphibole, and quartz. Biotite present as fine flakes. Dated as 14± m.y. (Lipman and others, 1970)

Tat

RHYOLITIC TO QUARTZ LATITIC ASH-FLOW TUFF

SHEETS--Moderately to densely welded;
commonly form cliffs or steep slopes.
Contain conspicuous phenocrysts of
sanidine, plagioclase, biotite, and
magnetite; some rocks contain sphene,
amphibole, and sparse pyroxene. Dated as
28-26 m.y. (Steven and Lipman, 1976)

Tigl ASH-FLOW LAVAS AND VOLCANIC SEDIMENTS-Andesitic to rhyolitic composition.
Occur between ash-flow tuff sheets (Unit
Taf). Exposed in southwest part of map

OLIGOCENE ASH-FLOW TUFF SHEETS

OLIGOCENE EARLY INTRUSIVE ROCKS

Tie MONZONITIC AND RHYOLITIC PORPHYRY PLUGS AND RELATED RHYOLITIC DIKES--Phenocrysts of feldspar and biotite common. Dikes are altered and slightly mineralized in

area; related to Uncompangre caldera

places. Intruded into early lavas in

northwest part of map area
OLIGOCENE PRE-ASH-FLOW LAVAS AND RELATED ROCKS

PREVOLCANIC ROCKS

LAVAS, BRECCIAS, TUFFS, AND CONGLOMERATES--Mostly of andesitic composition. Dated as 35-30 m.y. (Steven and Lipman, 1976)

UPPER JURASSIC MORRISON FORMATION AND MIDDLE
JURASSIC JUNCTION CREEK SANDSTONE-Mudstone to siltstone and quartzose
sandstone. Scattered remnants on an
erosional surface on Precambrian
crystalline rocks
PRECAMBRIAN GRANITE, GABBRO, METADIORITE, AND
METAVOLCANIC ROCKS--Intruded by an
alkalic igneous complex

APPROXIMATE BOUNDARY OF STUDY AREA

FAULT--Dashed where approximately located;
dotted where covered. Bar and ball on
downthrown side

CALDERA WALL--Hachured on downthrown side

LIMIT OF ROCK ALTERATION AND MODERATE MINERAL POTENTIAL

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a mineral and geologic survey of the Powderhorn Wilderness Study Area and Cannibal Plateau Roadless Area in the Gunnison National Forest, Gunnison and Hinsdale Counties, Colorado. The Powderhorn Wilderness Study Area was established by Public Law 94-579, October 21, 1976. The Cannibal Plateau Roadless Area (02218) was classified as a further planning area during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SUMMARY

The combined Powderhorn Wilderness Study Area and the contiguous Cannibal Plateau Roadless Area have a low potential for mineral and energy resources except in the southwesternmost part of the study area, where the caldera walls of the Lake City and Uncompandere volcanoes are located. This part of the study area has a moderate potential for the discovery of gold-silver vein deposits and other metals such as molybdenum in subvolcanic porphyries commonly associated at depth with silicic volcanism.

INTRODUCTION

The Powderhorn Wilderness Study Area covers approximately 51,000 acres (20,640 hectares) of land under U.S. Bureau of Land Management administration, and the adjoining Cannibal Plateau Roadless Area is approximately 29,500 acres (11,959 hectares) under U.S. Forest Service administration. The study area is on the Gunnison County-Hinsdale County boundary, approximately 50 mi (80 km) southwest of Gunnison and a few miles east of Lake City, Colo. (fig. 1). Part of the area has been known as the Powderhorn Primitive Area. The mineral resource potential of the study area has been assessed by the U.S. Geological Survey and the U.S. Bureau of Mines; this appraisal consisted of a geologic study and investigation of mines and prospects by the Geological Survey and the Bureau of Mines (this report), a geophysical survey (Martin and Sharp, 1983) by the Geological Survey, and a geochemical survey (Sharp and Lane, 1983) by the Geological Survey and the Bureau of Mines. Spectrographic analyses were made of approximately 120 stream-sediment and rock samples. No mining districts are within the study area, but the Lake City

mining district adjoins the study area at the southwest edge.

The study area lies on the northern flank of the San Juan volcanic field, between the Lake Fork of the Gunnison River on the west and Cebolla Creek on the east. Nearby Lake City is a well-known mining and resort town. The topography ranges from plateau tops at altitudes of approximately 12,500 ft (3,800 m) to valley floors at altitudes of approximately 8,500 ft (2,600 m). The study area is surrounded by well-maintained county roads, but access to the interior is mostly by trail. Only one logging road and one campground road on the north side extend into the study area. The west and east sides of the study area are marked by precipitous slopes and vertical cliffs

that flank the canyons of Cebolla Creek and the Lake Fork of the Gunnison River.

GEOLOGIC SETTING

The combined Powderhorn-Cannibal Plateau study area lies on the northern flank of the San Juan volcanic field (fig. 2), an extensive region underlain by a thick accumulation of Tertiary volcanic rocks. Older stratovolcanoes, intermediate in composition, 35-30 m.y. old, are overlain by a widespread ash-flow-tuff field that accumulated 30-22 m.y. ago. The sources for the ash-flow-tuff sheets are marked by clusters of volcanic subsidence structures (calderas) outside the study area; the western San Juan caldera complex is southwest, and the central San Juan caldera

complex is south and southeast (fig. 2). Flood-basalt lava flows deposited after the period of ash-flow eruptions and caldera subsidence cap the high ridges in and near the study area. To the north, near Powderhorn, Colo., erosion has cut through the volcanic cover to expose Precambrian crystalline rocks, which are believed to underlie most of the study area at depth. In the study area, the erosion surface between the Precambrian basement and the volcanic cover appears to dip a few degrees southwest, so that in combination with rising topography southward, the Tertiary volcanic pile increases in thickness from approximately 1,500 ft (450 m) in the northeast to 5,000 ft (1,500 m) in the southwest. The older stratovolcanoes in the vicinity of the study area consist of dark andesitic flows, flow breccias, and volcanic conglomerates (unit Tpl) that crop out along cliffs on the west side of the plateaus of the study area, and form the hills of the northwest terrane of the study area and beyond. The overlying younger ash-flow tuffs (unit Taf), derived from caldera sources to the southwest and southeast, form widespread sheets of moderately to densely welded rocks that are exposed along extensive cliffs flanking valley walls on the south and east sides of the study area and along the deep, linear valleys that drain northward. Dark flood-basalt lava flows cap the high plateau and associated ridges; these rocks (unit Tbb) are part of the Miocene and Pliocene Hinsdale Formation (Lipman and others, 1970), which consists of a bimodal assemblage of basalt lava flows and rhyolite

lava flows and pyroclastic rocks.

Several small plugs, marking former volcanic vents, cut the older lava flows and breccias of intermediate composition around the periphery of the study area. The Trout Creek plug, near the north edge of the study area, and the Larsen Creek plug, just west of the valley of the Lake Fork of the Gunnison River, are examples. Several rhyodacitic dikes cut the volcanic edifices around these plugs. Hydrothermal activity commonly altered rocks adjacent to the intrusive centers and related dikes during or

Hydrothermal activity commonly altered rocks adjacent to the intrusive centers and related dikes during or after intrusion.

Several late faults cut the volcanic rocks; along some of these faults the rocks are locally altered and show minor enrichment in several metals.

The southwest corner of the study area is essentially part of the older Uncompandere and younger Lake City volcanic calderas as shown by the caldera

subsidence structures and is the site of rock alteration and vein-forming processes. No mining has been done within the study area; minor prospecting has been done around the Trout Creek plug and at the southwest corner of the study area in the altered terrane associated with the Lake City caldera. However, mines near Lake City are on fissure veins that are near the boundary of the study area. The Golden Wonder Mine and others produced silver and gold sporadically until 1900, and the mines have been promoted, maintained, and reassessed for production since then until the present time. The cliffs and altered character of the volcanic rocks in places have been favorable for the formation of large landslides. The Slumgullion Slide, a short distance south of Lake City, is a famous tourist

wall lines. This part of the study area is the most

geologically complex because it is near large

ASSESSMENT OF MINERAL RESOURCE POTENTIAL

attraction. Several hundred years ago this slide

River, forming Lake San Cristobal.

blocked the valley of the Lake Fork of the Gunnison

The mineral resource survey, based on the geologic work, indicates that both the mineral and energy potential for the study area is generally low, if the southwest part of the Cannibal Plateau Roadless Area is excepted.

The study area is underlain entirely by volcanic rocks of Tertiary age along the northern side of the San Juan volcanic field. Despite the proximity of the study area to known mineralized districts near Lake City on the southwest and Powderhorn on the north and northeast, no evidence was seen in the geologic, geochemical, or geophysical surveys that indicates any significant mineral occurrences exist within the study area except at the southwest edge near Lake City. Surface geology does not indicate exposed centers of mineralization, and no geologic environments were interpreted that might indicate other hidden centers of this kind. Virtually all geochemical sampling results (Sharp and Lane, 1983; tables 1-8) can be explained by sources in different bedrock terranes; anomalous metal concentrations that might indicate proximity to mineral deposits were detected only in the southwest edge of the study area near Lake City. Results of aeromagnetic (Martin and Sharp, 1983) and gravity surveys generally can be explained by the known or reasonably inferred distribution of bedrock types, without invoking special circumstances that might specifically indicate mineral potential. Although several periods of mineralization can be documented in the volcanic rocks exposed in mining areas near Lake City to the southwest (Slack, 1976; Slack and Lipman, 1979; Steven and others, 1977), these episodes have affected rocks only within the area of the caldera that is in the southwest corner of the Cannibal Plateau Roadless Area near Slungullion Pass. None of these episodes has affected rocks within the Powderhorn Wilderness Study Area. The altered and mineralized rocks related to these periods of mineralization, sampled during the present study, did show anomalous concentrations of several metals (Sharp and Lane, 1983; table 5 and 6). Gold and silver have been mined in this terrane near the study area. These altered and mineralized rocks do overlap the study area and are considered to have moderate mineral potential, because they are part of the Lake City-Uncompangre caldera complex. No evidence was seen, however, to indicate that the altered and mineralized rocks extend northward or farther than the caldera rim into the study area (see map).

Many small mines and prospects in the Precambrian rocks near Powderhorn, north of the study area, were established to explore for base and precious metals, thorium, niobium, titanium, and rare-earth elements. Some of these mineral occurrences could well underlie the volcanic rocks exposed in the Powderhorn Wilderness Study Area. If so, however, they would be at depths of 1,500-5,000 ft (450-1,500 m), and would have no geological, geochemical, or presently available geophysical expression. Under these circumstances, the exploration or development of such deposits would not be economically justifiable.

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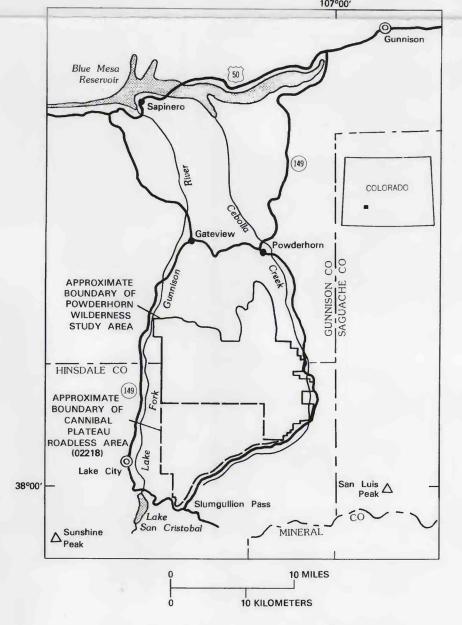
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INDEX MAP SHOWING THE LOCATION OF THE POWDERHORN WILDERNESS STUDY AREA AND THE CANNIBAL PLATEAU ROADLESS AREA (02218), GUNNISON AND HINSDALE COUNTIES, COLORADO

Box 25286, Federal Center, Denver, CO 80225